OC-725C

Oocyte Clamp　OC-725C 卵母细胞双电极电压钳放大器

The **OC-725C** Oocyte Clamp is designed for two-electrode, whole-cell voltage clamping of Xenopus oocytes. The dedicated design of the OC-725C includes such features as high compliance voltage (±180 V) and unique bath clamp circuitry. These same features also make the OC-725C ideal for clamping other large cells and cell structures such as squid axons. Improvements to this version include an extended current measuring range, decreased noise level and a 4-pole Bessel filter.

Fast Stable Voltage Clamping

The OC-725C combines high AC and DC gains and a voltage compliance of ±180 volts to insure fast, nonsaturating clamp performance under nearly any condition. The AC clamp gain is variable up to 2000. An additional DC gain of 1 x 10^6 may be employed for high conductance cells (leaky oocytes).

Two clamp speeds are available: The Slow mode is used for screening oocytes or for applications not requiring fast response times. The Fast mode is used for accurate voltage clamp of fast whole cell currents. Clamp response time in the Fast mode is 350 µsec (10-90% rise time) when applying a 100 mV step to a model cell.

Improved Bath Clamp Headstage

The current measuring range of the OC-725C bath clamp headstage has been extended at both ends by the addition of a 3 position range multiplier. Smaller currents are amplified to usable levels and larger currents up to 1 mA can be recorded without output saturation. The unique design of the bath clamp eliminates the need for series resistance compensation. It provides an accurate measurement of bath current by creating a virtual ground in the bath while simultaneously clamping the bath potential at zero.

Voltage Headstage Probe

The voltage measuring headstage is a single-ended, high-impedance probe. Its small size, convenient mounting rod and 2 meter cable make for easy attachment to a micropositioner. The headstage input is a 2 mm diameter pin. An electrode holder with a 2 mm jack (supplied) mounts directly on the headstage.

Voltage & Current Meters

Independent meters provide simultaneous displays of membrane voltage V_m and membrane current I_m. To assure proper impalement of the current electrode, the current meter displays membrane potential V_e from the current electrode before the clamp circuit is turned on.

Clamp Commands

The internal Hold control is a digital push button control with two ranges; ±1 to 99 mV (x1) and ±2 to 198 mV (x2). Hold can be incremented in steps of 1, 2, 10 and 20 mV for I-V studies. External command signals applied to Command IN ÷10 are attenuated to reduce noise from the command source. Hold and external commands are summed.

Additional Features

- **Buzz controls (1 kHz square wave) for each electrode aid in penetration of cell membranes with a minimum of leakage.**
- **Overload alarm (audible and visual) indicate when the compliance voltage is exceeded safeguarding the oocyte and indicating that current records are subject to saturation.**
- **DC Offsets for both voltage and current electrodes.**
- **Electrode Test for both electrodes.**
- **Capacity Compensation for the Vm voltage input.**

Electrode Holders

Two vented electrode holders with silver wires are typically required with the clamp; a straight type for use with the voltage headstage and a 45° type with mounting handle for use with current electrodes. Vents have been added to the electrodes to prevent pressure build-up inside the electrode which can damage oocytes. A two meter length cable assembly is provided to connect the current electrode holder to the clamp.

OC-725C

Oocyte Clamp (continued)

RC-3Z chamber shown with the Warner OC-725 bath clamp headstage. See pages 12 and 13..

Dual Oocyte Studies

Some studies, such as voltage control across gap junctions, require the clamping of two oocytes in a common bath using two voltage clamps. The combined currents from the two oocytes cause problems since the bath clamp headstage cannot separate the individual currents and therefore cannot provide effective clamping.

OC-725C has two features to address these problems:

- **An internal switch permits measurements of the current in series with the current electrode instead of in the bath.**
- **Optional differential voltage headstages (7255 DI): The differential measurement subtracts the voltage drop across the series resistance in the bath, which is normally eliminated by the bath clamp.**

Specifications

Test Conditions	
1. Model cell used to obtain specifications: model membrane, 1 MΩ in parallel with 220 nF, 1 MΩ current and voltage electrodes.	
2. Noise measurements made with an 8-pole Bessel filter.	
Voltage Recording Channel (Vm):	
V Probe Input Impedance	0.5 x 10^{12}Ω, 1 pF
Output Resistance	100 Ω
DC Offset	±200 mV at input, var. from zero with 10 turn control, (20 mV/turn)
Noise (0-10 kHz)	3 µV RMS with input grounded 20 µV RMS with model cell
Electrode Test	10 mV/MΩ read on meter 100 mV/MΩ at Vm x10 output
Meter Range	±199.9 mV full scale
Capacity Compensation	0 - 90 pF
Current Sensing (Bath Clamp) Channel (Im):	
Noise (0-1 kHz)	4.5 nA RMS with bath clamp 10 nA RMS in output leg
I Monitor Output	1 nA/mV to 1 mA/10V in 7 steps and 3 ranges, x0.1, x1, and x10
Gain Telegraph Output	0.2 to 2.6 V in 7 steps (200 mV/step) and 3 ranges, x0.1, x1, and x10. Compatible with data acquisition software*
Meter Range, Full Scale	Clamp Current: ±199.9 µA

Specifications (continued)

Electrode Voltage Ve	±199.9 mV (Current meter reads Ve when clamp mode switch is off)
Current Electrode Channel:	
Compliance Voltage	±180 V
Clamp Speed	350 µsec. (10-90%) with 100 mV square wave command applied to model cell
Gain	Variable AC/DC: 0 to 2000
Fixed DC Gain	Switch selected: 1 x 106
Ve DC Offset	±200 mV at input (20 mV/turn)
Electrode Test	10 mV/MΩ read on current meter 100 mV/MΩ at Ve x10 output, rear panel
Commands:	
Hold	Manually set with digital potentiometer, 2 digit resolution and 2 ranges: x1 range: ±1 to 99 mV in 1 mV steps x2 range: ±2 to 198 mV in 2 mV steps
External	Signals applied to COMMAND IN÷10 are attenuated by a factor of 10, 1 V applied = 100 mV command
Power Requirements	100-130 V or 220-240 VAC, 50/60 Hz, 20 VA
Physical Dimensions:	
Case	8.9 cm H x 43.2 cm W x 30.5 cm D
Voltage Headstage	12.5 mm D x 5 cm L with 1.8 m cable
Mounting Handle	4.8 mm D x 6.3 cm L
Bath Headstage	2.3 cm H x 3.5 cm W x 4.2 cm L with 1.8 m cable
Shipping Weight	6.8 kg
Warranty	Three years, parts & labor

**Axon pClamp and Instrutech Pulse*

Order #	Model	Product
W2 64-0028	OC-725C	Oocyte Clamp Supplied with 7250V voltage headstage, 7251I bath clamp headstage, 7259C current cable, model membrane and rack mount hardware. Specify line operating voltage if other than 100-130 VAC. One straight holder and one 45° holder need to be purchased separately.
Optional/Replacement Headstages		
W2 64-0030	7255DI	Optional Differential Headstage
W2 64-0031	7250V	Replacement Voltage Headstage
W2 64-0032	7251I	Replacement Bath Clamp Headstage
W2 64-0033	7259C	Replacement Current Electrode Cable
W2 64-0029	725MC	Model Cell
For Use with OC-725C Voltage Probe		
W2 64-1008	ESW-F12V	Straight Holder 1.2 mm Ag Wire
W2 64-1009	ESW-F15V	Straight Holder 1.5 mm Ag Wire
W2 64-1010	ESW-F20V	Straight Holder 2.0 mm Ag Wire
W2 64-1007	ESW-F10V	Straight Holder 1.0 mm Ag Wire
For Use with OC-725C Current Electrode		
W2 64-1051	E45W-F10VH	45° Style Holder 1.0 mm Ag Wire
W2 64-1052	E45W-F12VH	45° Style Holder 1.2 mm Ag Wire
W2 64-1053	E45W-F15VH	45° Style Holder 1.5 mm Ag Wire
W2 64-1054	E45W-F20VH	45° Style Holder 2.0 mm Ag Wire